

IN THE CLAIMS:

1. (Cancelled).

2. (Currently amended) The method for measuring the position of the liquid surface of the melt according to Claim 11 †, wherein the central reference point is measuring lines are set based on a central position of a seed crystal used taken in a necking process.

3. (Currently amended) The method for measuring the position of the liquid surface of the melt according to Claim 11 †, wherein thresholds for use in the detection of the intersections of the measuring lines and the fusion ring defined on the opposite sides of the fusion ring are dynamically set based on an average of a peak luminance of the fusion ring in such a manner that the thresholds of the intersections on the right and left hand sides in the image thereof are independent of each other.

4. (Currently amended) The method for measuring the position of the liquid surface of a melt according to Claim 11 †, wherein at least two sets each comprising a combination of two measuring lines are defined, and an average of the central positions of the single crystal corresponding to the respective combinations is taken as a measured value of the calculated center central position of the fusion circle single crystal.

5. (Currently amended) The method for measuring the position of the liquid surface of the melt according to Claim 11 †, wherein an image-measuring cycle and a time-period for averaging are determined based on a rotational speed of the a single crystal rotated while the single crystal is being pulled, and the calculated positions for the center of the fusion circle calculation results of the central position of the single crystal, obtained during the time-period for averaging, are averaged.

6. (Currently amended) A device for measuring a position of a liquid surface of a melt, from which an image of a fusion ring existing in a boundary between a single crystal is pulled by a Czochralski method, with a fusion ring existing at in a boundary between the a single crystal and the melt is measured, wherein the center of the fusion ring is calculated a central position of the single crystal is detected based on the image, and the position of the liquid surface of the melt is determined based on the calculated center of the fusion ring detected result, the device comprising:

means for capturing an image of the fusion ring;

means for setting at least two spaced apart measuring lines across in the captured image of the fusion ring below a central reference point in the captured image;

means for detecting the intersections of the respective measuring lines and the fusion ring, the intersections being located are on the opposite sides of the fusion ring; and

means for calculating the center central position of the fusion ring single crystal based on the intervals between the intersections on the opposite sides of the

fusion ring.

7. (Currently amended) The device for measuring the position of the liquid surface of the melt according to Claim 6, wherein the means for setting measuring lines sets the measuring lines based on the central position of a seed crystal in a necking process.

8. (Original) The device for measuring the position of the liquid surface of the melt according to Claim 6, wherein the means for detecting intersections dynamically sets thresholds for use in the detection of the intersections of the measuring lines and the fusion ring defined on the opposite sides of the fusion ring, based on the average of a peak luminance of the fusion ring in such a manner that the thresholds of the intersections on right and left hand sides are independent of each other.

9. (Currently amended) The device for measuring the position of the liquid surface of the melt according to Claim 6, wherein the means for setting measuring lines defines at least two sets each comprising a combination of two measuring lines, the means for detecting intersections detects all of the intersections of the measuring lines, and the means for calculating the center of the fusion ring averages values for the center of the fusion ring calculated for each of central position takes, as a measured value of the central position of the single crystal, an average of the calculated results of the central position of the single crystal corresponding to the respective combinations of measuring lines.

10. (Currently amended) The device for measuring the position of the liquid surface of the melt according to Claim 6, wherein the means for calculating the center of the fusion ring central position determines an image measuring cycle and a time period for averaging based on a rotational speed of the single crystal rotated while the single crystal is being pulled, and averages the calculated results for of the center central position of the fusion ring single crystal obtained during the time period for averaging.

11. (New) A method for measuring the position of a liquid surface of a melt from which a single crystal is pulled by a Czochralski method, the method comprising:

capturing an image of a fusion ring at a boundary between the single crystal and the melt;

setting a first measuring line across the captured image below a central reference point in the captured image;

setting a second measuring line across the captured image spaced below and parallel to the first measuring line;

detecting the positions in the captured image of intersections of the respective measuring lines and the fusion ring defined on opposite sides of the fusion ring and determining the interval between the intersections on each measuring line;

calculating the center of the fusion circle based on the detected positions of the intersections of the respective measuring lines and the determined intervals between the intersections for each measuring line; and

determining the position of the liquid surface of the melt based on the calculated center of the fusion circle.

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12. (New) The method for measuring the position of the liquid surface of the melt according to Claim 11, wherein the center of the fusion ring is calculated according to the following formula:

$$Y = \{Y_1 + Y_2 + (W_1^2 - W_2^2)/4(Y_1 - Y_2)\}/2$$

wherein:

a vertical line through the reference point defines a Y-axis;

Y is the Y-axis position of the center of the fusion ring;

Y₁ is the Y-axis position of the first measuring line;

Y₂ is the Y-axis position of the second measuring line;

W₁ is the interval between the intersections on the first measuring line; and

W₂ is the interval between the intersections on the second measuring line.

13. (New) The device for measuring position of the liquid surface of the melt according to claim 6 wherein the means for capturing an image of the fusion ring is a stationary two-dimensional CCD camera.